
NEWSLETTER

HOMEBREW COMPUTER CLUB

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RANDOM DATA

By Robert Reiling

This issue of the *Newsletter* has exciting changes which reflect the growth of the **Homebrew Computer Club** and expanding hobby computer activities. **Laurel Publications**, deeply involved in various computer related publications and support documentation is donating typesetting, graphics and editorial assistance that allows major improvements in the *Newsletter*. **Joel Miller** of **Laurel Publications** is the person to thank for this.

Tom Pittman's byte saving tricks (page 3) should help you save some program space. Let us hear from you with some of your pet ideas; it is what the club is all about—information exchange to help each of us with our systems.

Kenneth Young wrote in with a report of the last **Southern California Computer Society (SCCS)** meeting and included his observations about the **Altair 8800B**. The following excerpt is from Ken's letter: *"Pat Ward and David Bunnell of MITs were one of the vendors at the meeting and they were showing off the Altair 8800B. I liked it. They cleaned up their computer a lot. I feel that this machine is comparable to the IMSAI 8080 with a 22-slot motherboard and fan. Unfortunately, the Altair 8800B will cost about \$840 in kit form. The IMSAI 8080 with a 28-Amp power supply, 22-slot motherboard and fan costs \$680 (IMSAI does not charge that insulting 5% handling fee anymore, so I have been told). The two computers are a little different, but I do feel they are comparable to one another. However, I do not feel that the Altair 8800B should cost more than the IMSAI. My conclusion is that the IMSAI is still a better deal than the Altair."*

Development of **LO*OP Center's** latest course is almost finished. It is to be called **Computer Orientation For Office Personnel**, or, *Dragon Taming*. The course is designed for people who have no initiation into the rites of data processing and find that their jobs necessitate working with input and output and trying to communicate with computer freaks. This seminar should appeal to anyone from top level management to the lowliest file clerk. The course will be a one-day event and will include a pleasant and civilized lunch for human beings. Maximum class size is 6. For further information, call **LO*OP Center**, (707) 795-0405.

If you have received the first three issues of **Dr. Dobbs Journal Of Computer Calisthenics And Othodontia**, you will surely be interested in continuing your subscription. If not, get in touch with **PCC**, Box 310, Menlo Park, Ca. 94025 and get information on this publication. A reminder—you need to send your sub-

scription renewal to get those issues after number three if you were an initial subscriber. Subscription is \$10 per year for 10 issues. Lots of information about *Tiny BASIC* and more.

Jef Raskin's discussion of **FLOW**, an instructional computer programming language, at the May 26th meeting of the **Homebrew Computer Club** interested quite a few members. For a brief discussion of the language, have your librarian get a copy of *Computers And The Humanities*, Vol. 8, pp 231-237, Pergamon Press, 1974.

NEWSLETTER EVOLVING

By Joel Miller

Probably you have already noticed some changes in the graphics and presentation of the *Newsletter*; we hope there are a lot more to come. Starting with this issue, the *Newsletter* will embark on an evolutionary process with changes both in format and content.

To increase the appeal and readability of the *Newsletter*, **Laurel Publications** will be donating typesetting services on their computerized typesetting/text editing system as well as providing graphics, lay-out and editorial services. **Bob Reiling** will continue as chief editor and director of the *Newsletter* and, as most of you are already aware, **Tom Pittman** is the man to speak to regarding the mailing list.

The *Newsletter* is published monthly by the **Homebrew Computer Club** and is financed solely by donations from club members.

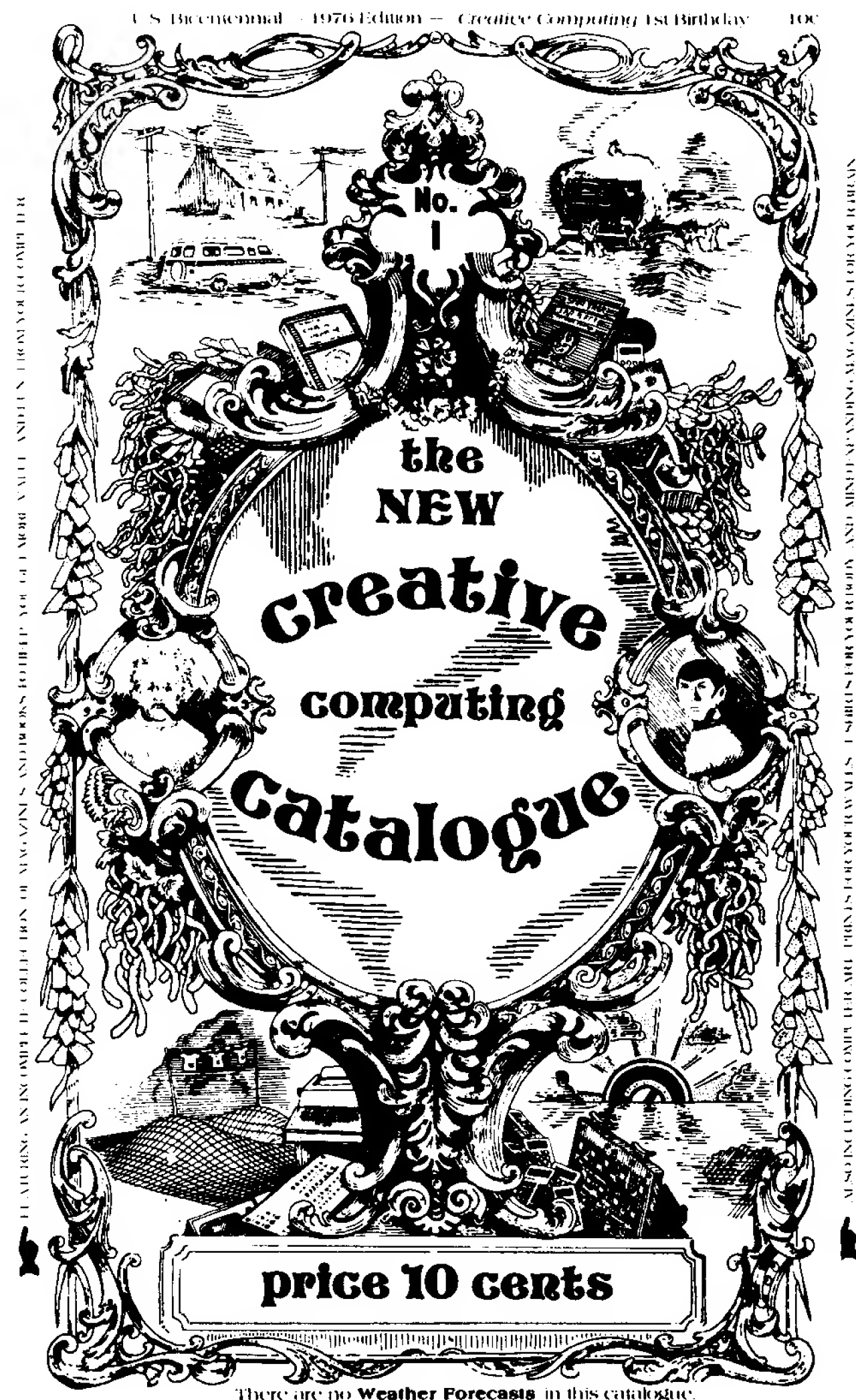
A number of suggestions have been made by club members regarding possible changes in the style and content of the *Newsletter*. First—and most important of all—the *Newsletter* needs contributors for stories and articles. We know there are a lot of you out there who have a great many interesting things to tell the rest of us and the number of possible subjects for articles is almost unlimited. Some "road test" analyses of new systems is obviously in order as there are so many new microcomputers being introduced into the marketplace. Some personalized articles about home-built systems (how they came together, how much they cost and where to get necessary components) would be of great interest to us all.

If you have something to say, don't be afraid to write an article even if you have never written anything before. Everybody who reads the *Newsletter* is interested in *what* you have to say, not how you say it. Plus, if you do feel you need help in rewriting an article, contact **Bob Reiling** at (415) 967-6754 or **Joel Miller** at (408) 353-3609.

NEW CREATIVE COMPUTING CATALOG

A zany 12-page tabloid newspaper much in the style of the "Old Farmers Almanac" called, appropriately enough, the **New Creative Computing Catalog** describes various products available from *Creative Computing*.

Eighteen books are described including the popular *101 BASIC Computer Games* and the newly released *Artist and Computer*. A T-shirt with a computerized picture of Albert Einstein is offered along with a wide variety of computer art prints ranging from a MR. Spock Computer Image to a multi-color sunrise print. Both *Creative Computing* and *Byte Magazine* are described in detail.



One page details special discount terms for schools, clubs and retail stores, as well as ordering information for foreign countries. Even if you don't order anything, the catalog will be a conversation piece. The catalog is a bargain at only 10 cents plus 21 cents postage, but will be sent free for a limited time to readers of the **Homebrew Computer Club Newsletter**. Write *Creative Computing*, P.O. 789-M, Morristown, N.J. 07960.

BULLETIN BOARD

Help Wanted. Daly city shop needs someone familiar with Altair 8800 bus-compatible hardware and software to answer customer's questions on Saturdays at \$3.00 per hour. Minimum age: 15. **Action Audio Electronics Repair**, Westlake Shopping Center, 323 S. Mayfair Ave., Daly City 94015. Phone: (415) 756-7440.

Teletypes: Models 28 through 40, new or rebuilt, RO's, KSR's and ASR's. All available immediately. **National Typewriter Corp.**, 207 Newtown Rd., Plainview, N.Y. 11803. Contact Joe Gibbons at (516) 293-0444.

For Sale. One 8008 CPU chip. \$15 or best offer. Also 16 1101 RAM chips—\$1 per chip. Write **David Ambrose** at 1494 Solano Ave., #1, Albany, Ca. 94706 or call at (415) 526-6702.

Crystals For AMI Prototype Boards—2.4576MHz crystals for AMI boards in stock: \$8.95 each. **Solid State Music**, 2102A Walsh Ave., Santa Clara, Ca. 95050, or phone (408) 246-2707.

73 Magazine. Special club subscription rate available if five or more send in. Only \$7.50 per year for each subscription. If interested, contact **Bob Reiling** at (415) 967-6754 (Mountain View) after 7:00PM, please.

Logic Seminars. There will be four 2½ hour sessions on Wednesday evenings from 7 to 9:30PM beginning June 16. Tuition is \$35, however ACM member will receive a \$5 discount. The instructor, **Norman Wheelock**, is an applications engineer at Siliconix. The sessions will cover *basic digital electronic theory*—gates, Boolean algebra, basic counters; *advanced discrete logic theory*—counter design, logic sequences; *small logic systems*—putting gates and counters to work; *large scale integrated devices*—discussion and application of presently available LSI systems. Some exposure to computer programming or hardware is advisable. Enrollment is limited. Call to register or mail in your check. **Community Computer Center**, 1919 Menalto Ave., Menlo Park, Ca. 94025. Phone: (415) 326-4444.

Microcomputer Interfacing Workshop. September 23, 24 and 25, 1976. A three-day workshop based on the popular 8080 microprocessor. The course is sponsored by the V.P.I. and S.U. Extension Division of the Continuing Education Center in Blacksburg, Va. This workshop will include many hours of experience in programming and interface construction with over 12 operating microcomputers available for participant use. For more information, contact **Dr. Norris Bell**, V.P.I. & S.U. Continuing Education Center, Blacksburg, Va. 24061 or call (703) 951 6328.

The Digital Group recently released **Flyer Number 6** with their latest products and software offerings. Included are a cassette storage system capable of controlling up to four Phi-Deck cassette transports, a nine inch Sanyo video monitor and several software programs including *Tiny BASIC Extended*. Write for information and prices to the **Digital Group**, P.O. Box 6528, Denver, Colorado 80206.

BYTE SAVING PROGRAMMING TRICKS FOR THE 8080

By Tom Pittman

These are some programming tricks I have accumulated over the years which can often save a byte or two in 8080 programs. Because of the peculiarities in the instruction sets, only a few of these also apply to 6800 programs and are so noted. Many of these tricks are widespread lore; some I have never seen elsewhere. I hope they can help you as well.

For 2's complement signed arithmetic, it is sometimes necessary to add a signed 1-byte number to a larger format. There are also other reasons for spreading a single bit (in the Carry FF) to a whole byte (in A). I found this one in the Scelbi book:

SBB A Copy carry to all bits in A

The 8080 does not have a proper shift instruction which fills the vacated bits with zeroes. Normally, a *CLC* must precede the *RAR* instruction. However, for left shifts:

ADD Shift with zero insert

To insert a single bit (in the Carry) into the left or right end of the A without altering the other seven bits:

RAL Remove old left bit
RRC Insert new from Carry

The right-end version is symmetrical. To divide a signed (2's complement) number in half, it is necessary to keep the sign bit (bit 7) unchanged while shifting A right. The 8080 does not have an instruction for this, but the *RAR* may be used if the Carry can be set up to match the sign bit:

RLC Copy bit 7 to Carry
RRC Restore A

The 6800 has a single instruction for signed right shifts, but no circular rotate. To copy a sign into the Carry:

ASR A (6800) Duplicate bit 7
ROL A Restore A with bit 7 in Carry

Some of these other tricks with the Carry become more useful if the Carry can be set on the basis of the other conditions. A zero in A may be converted into either a one or a zero in the Carry (so that non-zero is the reverse) by one of the following instructions (this also works in the 6800 with appropriate opcode substitutions):

ADI 0FFH C=0 if and only if A=00
SUI 1 C=1 if and only if A=00

It is easy to get the sign of A into the Carry (any left shift will do); to get the complement of the sign is a little trickier. This instruction leaves the contents of A unchanged, and also works for the 8080:

CPI 80H Complement bit 7 to Carry

Finally, how do you pack a byte with some bits from A and some bits from B? The Univac 1108 has a special instruction called *Masked Load Upper* which does this. The 8080 (and also the 6800—but only when the second byte is in memory) can do this in three instructions! Assume that the data in A and B (or any other register or memory location) are already in the correct bit positions. The mask represents a byte with the ones where the data in A is to be substituted; the non-data bits of A and B may contain garbage, as they are ignored:

XRA B XOR B to A data bits
ANI Mask Delete A garbage
XRA B Insert B data

The theory behind this trick lies in the fact that the *XOR* operation may be considered a "selective complement" instruction. In other words, where there are ones in B the bits in A are complemented, and where there are ones in B the bits in A are unchanged. The *AND* operation, on the other hand, may be thought of as selectively setting bits to zero in A, where the zeroes in the mask set bits in A to zero and ones in the mask leave the bits in A unchanged. Assume for the moment that the mask is all ones; the other two instructions exactly cancel each other, leaving A unchanged, since the ones in B complemented the corresponding bits in A the first time and recomplemented the same bits (back to their original states) the second time. Thus ones in the mask retain the original bits in A. Now consider zeroes in the mask: here the corresponding bits of A are cleared to zero by the *AND* operation so that the first *XOR* has no effect; the second *XOR* simply complements those zeroes in A which correspond to ones in B, which is to say that it copies the bits of B into A (remember A was cleared to zeroes by the *AND* operation). Thus zeroes in the mask copy in bits from B. Since each bit operates independently, there is no requirement that the selected bits of A or B be contiguous. Note also that no other registers or memory is required for this procedure, and that B is unchanged. I realize this operation looks suspicious, so I have included the following truth table:

A	B	MASK	1st XOR	AND	2nd XOR
0	0	0	0	0	0 = B
0	0	1	0	0	0 = A
0	1	0	1	0	0 = B
0	1	1	1	1	0 = A
1	0	0	1	0	0 = B
1	0	1	1	1	1 = A
1	1	0	0	0	1 = B
1	1	1	0	0	1 = A

FIGURE 1 Byte Packing Truth Table

.AR=2

.G10

P=1

P=2

```
;
;
; PROCESSOR TECHNOLOGY REFORMATOR
;
; THIS PROGRAM TAKES 8080 ASSEMBLY
; SOURCE PROGRAMS WRITTEN ON INTEL'S
; INTELLEC 8 WHICH HAVE COLONS AFTER
; LABELS, CONTROL-I'S FOR TABS,
; AND SEMICOLONS TO DENOTE COMMENTS.
;
; IT CONVERTS THEM TO PROCESSOR
; TECHNOLOGY'S FORMAT WITH LINE
; NUMBERS, '*' TO DENOTE COMMENTS,
; AND NO SEMICOLONS AFTER LABELS.
;
; THE READER MUST BE UNDER PROGRAM CONTROL.
; THAT IS IT MUST BE STOPPED AFTER EACH
; CHARACTER IS READ IN.
;
; THIS RUNS ON THE INTELEC/8
; IT STARTS AT LOCATION 10H
; AND USES THE INTEL MONITOR
; FOR I/O
;
000D CR EQU 0DH
000A LF EQU 0AH
3806 RI EQU 3806H ;READER INPUT
3809 CO EQU 3809H ;CONSOLE OUTPUT
;
;
0000 ORG 10H
;
;
0010 310001 START: LXI SP,0100H ;INITILIZE STACK
0013 CD8100 CALL CRCHK ;INPUT A CHARACTER
;
; PRINT OUT 4 ASCII DECIMAL DIGITS
;
0016 F5 MDEC: PUSH PSW
0017 21A900 LXI H,DNUM+3
001A 7E MD1: MOV A,M
001B 3C INR A
001C FE3A CPI '9'+1 ;TOO BIG?
001E C22700 JNZ MD2
0021 3630 MVI M,'0'
0023 2B DCX H ;DO THE NEXT DIGIT
0024 C31A00 JMP MD1
0027 77 MD2: MOV M,A
0028 21A500 LXI H,DNUM-1
002B CDA000 CALL DPRT
002E CDA000 CALL DPRT
0031 CDA000 CALL DPRT
0034 CDA000 CALL DPRT
0037 0E20 MVI C,' '
0039 CD0938 CALL CO
;
; FIRST COLUMN, CHECK FOR A LABEL
;
003C F1 FFCHK: POP PSW
003D FE3B CPI ';' ;COMMENT?
003F C24E00 JNZ LBCHK
0042 0E2A MVI C,'*'
0044 CD0938 FC1: CALL CO ;PROCESS A COMMENT
0047 CD8100 CALL CRCHK
004A 4F MOV C,A
004B C34400 JMP FC1
;
; CHECK FOR A LABEL
;
004E FE20 LBCHK: CPI ' '
0050 CA6100 JZ POC ;NO LABEL
0053 4F LBC1: MOV C,A
0054 CD0938 CALL CO
0057 CD8100 CALL CRCHK
005A FE3A CPI ';' ;DELETE ';'
005C C25300 JNZ LBC1 ;LOOP TO PRINT
005F 3E20 MVI A,' ' ;' ' SEPARTES LABEL AND OP-CODE
```

```
;
;
; DO THE OPCODE, OPPEERAND, AND COMMENT
; MULTIPLE BLANKS BECOME SINGLE BLANKS
;
0061 4F POC: MOV C,A
0062 CD0938 CALL CO
0065 CD8100 POC1: CALL CRCHK
0068 FE20 CPI ';'
006A CA6500 JZ POC1
006D FE3B CPI ';'
006F CA4400 JZ FC1
0072 4F POC2: MOV C,A
0073 CD0938 CALL CO
0076 CD8100 CALL CRCHK
0079 FE20 CPI ';'
007B C27200 JNZ POC2
007E C36100 JMP POC
;
; READ A CHARACTER, MASK OFF PARITY.
; IF ITS A CARRIAGE RETURN, THEN
; DO THE END OF LINE THING
; CONVERT CONTROL-I'S TO BLANKS.
; REPRODUCE LEADER.
;
0081 CD0638 CRCHK: CALL RI ;GET THE CHARACTER
0084 E67F ANI 7FH ;MASK PARITY
0086 FE0D CPI CR
0088 CA9500 JZ CRC1 ;ITS THE END
008B B7 ORA A
008C CA9900 JZ CRC2 ;REPRODUCE LEADER!!
008F FE09 CPI 09H ;CONTROL-I IS A TAB
0091 C0 RNZ ;NOT CONTROL-I
0092 3E20 MVI A,' '
0094 C9 RET ;REPLACE WITH ' '
0095 E1 CRC1: POP H ;FORGET RETURN
0096 C3AA00 JMP NLINE ;GO TO END OF LINE
0099 4F CRC2: MOV C,A
009A CD0938 CALL CO ;OUTPUT LEADER
009D C38100 JMP CRCHK
;
; PRINT OUT ((H,L)) AS AN
; ASCII DECIMAL DIGIT.
;
00A0 23 DPRT: INX H
00A1 4E MOV C,M
00A2 CD0938 CALL CO
00A5 C9 RET
;
;
00A6 30303030 DNUM: DB '0000'
;
;
; TERMINATE A LINE WITH A
; CARRIAGE-RETURN, LINE-FEED
; AND GO PRINT THE NEXT LINE NUMBER.
;
00AA 0E0D NLINE: MVI C,CR
00AC CD0938 CALL CO
00AF 0E0A MVI C,LF
00B1 CD0938 CALL CO
00B4 CD8100 NL2: CALL CRCHK
00B7 FE0A CPI LF
00B9 CAB400 JZ NL2
00BC C31600 JMP MDEC
;
;
0000 END
```

P=

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TAPES.....

```

0001 *
0002 *
0003 * PROCESSOR TECHNOLOGY REFORMATOR
0004 *
0005 * THIS PROGRAM TAKES 8080 ASSEMBLY
0006 * SOURCE PROGRAMS WRITTEN ON INTEL'S
0007 * INTELLEC 8 WHICH HAVE COLONS AFTER
0008 * LABELS, CONTROL-I'S FOR TABS,
0009 * AND SEMICOLONS TO DENOTE COMMENTS.
0010 *
0011 *
0012 * IT CONVERTS THEM TO PROCESSOR
0013 * TECHNOLOGY'S FORMAT WITH LINE
0014 * NUMBERS, '*' TO DENOTE COMMENTS,
0015 * AND NO SEMICOLONS AFTER LABELS.
0016 *
0017 *
0018 * THE READER MUST BE UNDER PROGRAM CONTROL.
0019 * THAT IS IT MUST BE STOPPED AFTER EACH
0020 * CHARACTER IS READ IN.
0021 *
0022 *
0023 * THIS RUNS ON THE INTELEC/8
0024 * IT STARTS AT LOCATION 10H
0025 * AND USES THE INTEL MONITOR
0026 * FOR I/O
0027 *
0028 CR EQU 0DH
0029 LF EQU 0AH
0030 RI EQU 3806H ;READER INPUT
0031 CO EQU 3809H ;CONSOLE OUTPUT
0032 *
0033 *
0034 ORG 10H
0035 *
0036 *
0037 START LXI SP,0100H INITILIZE STACK
0038 CALL CRCHK INPUT A CHARACTER
0039 *
0040 *
0041 * PRINT OUT 4 ASCII DECIMAL DIGITS
0042 *
0043 MDEC PUSH PSW
0044 LXI H,DNUM+3
0045 MDI MOV A,M
0046 INR A
0047 CPI '9'+1 TOO BIG?
0048 JNZ MD2
0049 MVI M,'0'
0050 DCX H DO THE NEXT DIGIT
0051 JMP MDI
0052 MD2 MOV M,A
0053 LXI H,DNUM-1
0054 CALL DPRT
0055 CALL DPRT
0056 CALL DPRT
0057 CALL DPRT
0058 MVI C,' '
0059 CALL CO
0060 *
0061 * FIRST COLUMN, CHECK FOR A LABEL
0062 *
0063 FFCHK POP PSW
0064 CPI ';' COMMENT?
0065 JNZ LBCHK
0066 MVI C,'*'
0067 FCI CALL CO PROCESS A COMMENT
0068 CALL CRCHK
0069 MOV C,A
0070 JMP FCI
0071 *
0072 *
0073 * CHECK FOR A LABEL
0074 *
0075 LBCHK CPI ' '
0076 JZ POC NO LABEL
0077 LBCI MOV C,A
0078 CALL CO
0079 CALL CRCHK
0080 CPI ':' DELETE ':'
0081 JNZ LBCI LOOP TO PRINT
0082 MVI A,' ' SEPARTES LABEL AND OP-CODE

```

```

0083 *
0084 *
0085 * DO THE OPCODE, OPPERAND, AND COMMENT
0086 * MULTIPLE BLANKS BECOME SINGLE BLANKS
0087 *
0088 POC MOV C,A
0089 CALL CO
0090 POC1 CALL CRCHK
0091 CPI ' '
0092 JZ POC1
0093 CPI ';'
0094 JZ FCI
0095 POC2 MOV C,A
0096 CALL CO
0097 CALL CRCHK
0098 CPI ' '
0099 JNZ POC2
0100 JMP POC
0101 *
0102 *
0103 * READ A CHARACTER, MASK OFF PARITY.
0104 * IF ITS A CARRIAGE RETURN, THEN
0105 * DO THE END OF LINE THING
0106 * CONVERT CONTROL-I'S TO BLANKS.
0107 * REPRODUCE LEADER.
0108 *
0109 CRCHK CALL RI GET THE CHARACTER
0110 ANI 7FH MASK PARITY
0111 CPI CR
0112 JZ CRC1 ITS THE END
0113 ORA A
0114 JZ CRC2 REPRODUCE LEADER!!
0115 CPI 09H CONTROL-I IS A TAB
0116 RNZ NOT CONTROL-I
0117 MVI A,' '
0118 RET REPLACE WITH ' '
0119 CRC1 POP H FORGET RETURN
0120 JMP NLINE GO TO END OF LINE
0121 CRC2 MOV C,A
0122 CALL CO OUTPUT LEADER
0123 JMP CRCHK
0124 *
0125 *
0126 * PRINT OUT ((H,L)) AS AN
0127 * ASCII DECIMAL DIGIT.
0128 *
0129 DPRT INX H
0130 MOV C,M
0131 CALL CO
0132 RET
0133 *
0134 *
0135 DNUM DB '0000'
0136 *
0137 *
0138 * TERMINATE A LINE WITH A
0139 * CARRIAGE-RETURN, LINE-FEED
0140 * AND GO PRINT THE NEXT LINE NUMBER.
0141 *
0142 NLINE MVI C,CR
0143 CALL CO
0144 MVI C,LF
0145 CALL CO
0146 NL2 CALL CRCHK
0147 CPI LF
0148 JZ NL2
0149 JMP MDEC
0150 *
0151 *
0152 END
0153 *
0154 *
0155 *

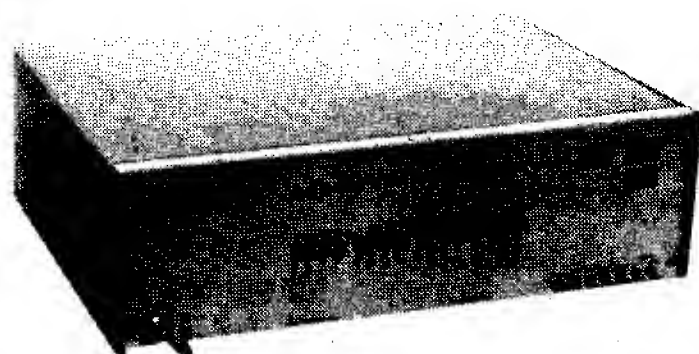
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NEW MICROCOMPUTER

At last, the much talked about **Astral 2000** micro-computer is ready to go. If you were at the last meeting of the **Homebrew Computer Club**, you were among the first to see an actual demonstration of the **Astral** given by **Marty Spergel** from **M&R Enterprises**, the manufacturer of the **Astral**.

The **Astral** is a significant feather in the cap of the **Homebrew Computer Club** for it has been designed and manufactured entirely by club members. The chief engineer for the **Astral** project is **Carl Kelb** who operates his own consulting firm, **R C Engineering Co.**

The **Astral 2000** is an extremely powerful micro, so powerful that **Carl Helmers** of **Byte** magazine has described it more as a *mini* than as a micro in terms of capabilities and expandability.



Astral 2000 Microcomputer

The system is housed in a well-built, professional quality cabinet and incorporates a modular power supply from **PowerTec** which is quite adequate for the job. An interesting item to note about the assembly of the **Astral** is that there is not a single wire in the entire machine. Correction: there is one actually—the line cord. All the other components plug directly into an expanable system bus, including the front panel assembly. Although the **Astral** is advertised as a “kit”, in reality it is 90% assembled upon delivery. All boards are fully stuffed, tested and burned in for a minimum of 24 hours. The only assembly procedures required are simply putting the cabinet together, placing the power supply inside and bolting it down, attaching the line cord and inserting the various circuit boards.

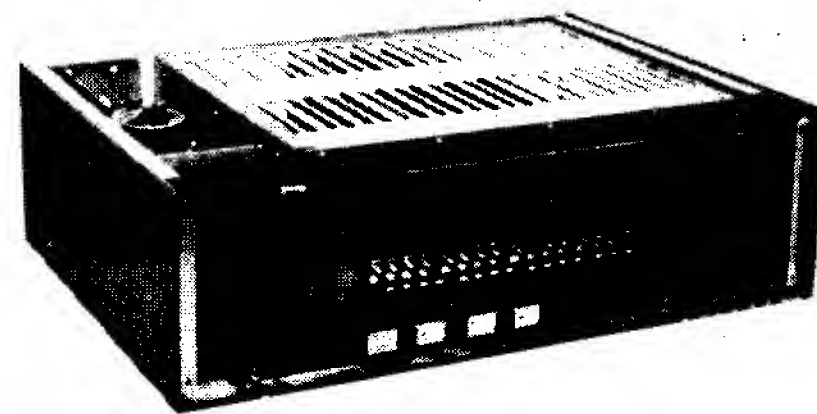
The front panel assembly contains the usual sets of LEDs and switches, however there are a few interesting features which should be pointed out. A real time clock driven by an integrated clock chip reads out time in hours, minutes and seconds. The same displays used for the clock can also be used to read out programs in hex, an invaluable debugging aid. In addition, the front panel is attached to the back plane by a special connector arrangement designed in such a way that the two assemblies simply are snapped together. Remember putting together that incredible wiring harness for your **Altair**? Well, rest assured that will never happen with the **Astral**.

Three circuit boards are currently available for the

system. The processor board contains a 6800 MPU and a great number of other devices as well. The processor operates both in serial and parallel. The serial I/O port outputs both RS-232 and 20mA current loop for teletypes. The serial I/O port is fully protected by optoisolators. The processor board is shipped with Motorola's MIKBUG monitor and 384 bytes of 6810-1 RAM installed.

Two types of memory boards are in production for the system. The first is the 8K RAM board which utilizes low power static RAMs with a 500ns cycle time. The entire 8K RAM board draws a mere 1.5A from a single +5V supply. With the MIKBUG installed, only five RAM boards can be addressed by the processor, however without MIKBUG, the 6800 can talk to 65K of memory (8 RAM boards). The location of each RAM board in the memory map is selected by a set of jumpers on the RAM board itself.

And for you people out there who are drowning in paper tape, an 8K EPROM board is available for either the Motorola or the AMI 5204 erasable PROMs. This board is fully stuffed with all the miscellaneous control and decode logic, however it does not contain the EPROMs although sockets for the EPROMs are furnished.



Astral 2000 With Front Panel Cover Removed

A video display module has already been designed by our venerable club leader, **Lee Felsentein** who is also responsible for the design of both the **VDM-1 (Processor Technology)** and the **Pennywhistle 103** acoustic coupler (**M&R Enterprises** again). This new display module (the **VID-80**) has been designed specifically for the **Astral** and—of course—plugs directly into the system bus with no further ado. The **VID-80** offers selectable line length with adjustments for 64, 72 and 80 characters per line. The **VID-80** will display up to 24 lines of upper and lower case characters.

Other future additions to the system will include a number of inexpensive peripherals. Although Marty is still negotiating with various manufacturers, he does expect to be able to offer reasonably priced digital tape decks, tape readers and floppy disks with controllers implemented on **Astral** bus-compatible cards.

Initially, software will include a special version of BASIC designed specifically for operating in this system. BASIC will be available both in tape and in PROM.

REPORT ON AMI PROTOTYPE BOARDS

By Ray Boaz

A total of 58 units were purchased with final delivery early in May. I still have some items—please pick them up!

Several units have been completed and are up. Two people from AMI were at the May 26th meeting of the **Homebrew Computer Club** with equipment to help with problems. Two boards were checked out during the meeting.

We are currently working on another buy of a minimum of 25 units. After June 30, the AMI price will be \$170+. The **Long Island Computer Association** may go in with us on this buy.

We have planned a meeting at the home of **Dr. Richard J. Sherman**, 10595 Orange Tree Lane, Cupertino on June 16, 1976 at 7:30PM. The purpose of this meeting is to (1) set up a group buy of parts needed to complete the boards, (2) discuss problems associated with getting the boards up and (3) pass on some information on how to use the firmware supplied with the boards.

HOME BREW COMPUTER CLUB MEETINGS

The **Homebrew Computer Club** meets every other Wednesday (June 23rd, July 7th, July 21st, etc.), 7PM at the **Stanford Linear Accelerator Center Auditorium**. Directions: From Freeway Rt. 280, take the **Sand Hill** exit east toward Menlo Park. Turn right at **S.L.A.C** sign. Auditorium is directly ahead. The parking area is to your right.

NEWSLETTERS

By Robert Reiling

Recent newsletters I have received: **I/O**, South Florida Computer Group, Jim Whitmore, Editor, 410

N.W. 117 St., Miami, Fl. 33168.

First issue in May, 1976. It is the newsletter for two chapters of the **South Florida Computer Group**; one in Miami and the other in Fort Lauderdale. Club News, product news, and software and hardware articles. Currently eight to ten pages.

Northwest Computer Club Newsletter, P.O. Box 5304, Seattle, Wa. 98109, Bob Wallace, Editor.

First issue in March 1976. Club news and varied hardware/software articles. April and May issues have some interesting reproductions of graphics.

LOW COST PRINTER

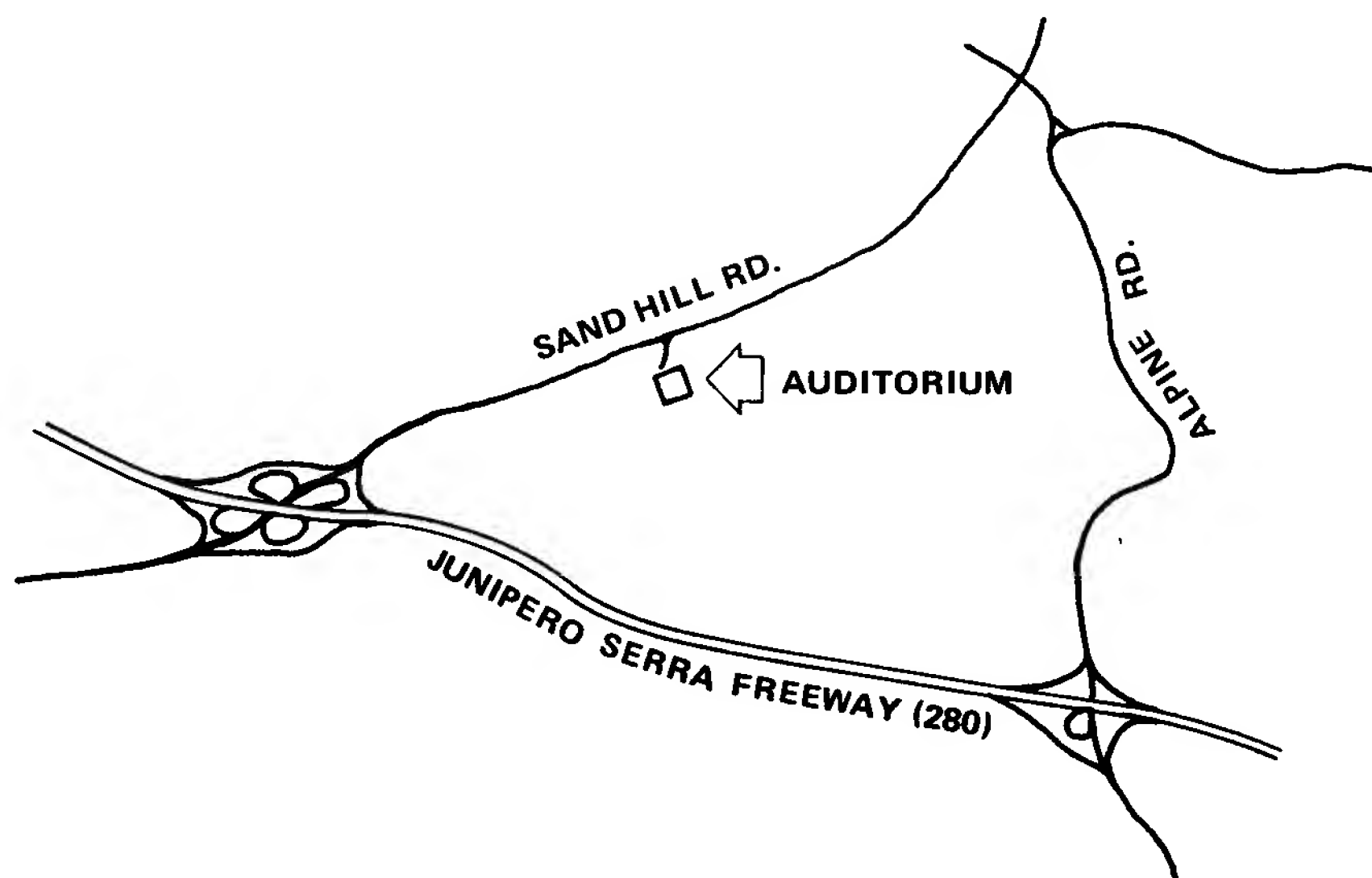
News Release

San Diego—**Electronic Products Associates, Inc.**, 1157 Vega St., San Diego, Ca. 92110, (714) 276-8911 has announced the availability of a new, low cost, 40 column, dot-matrix impact printer. The printer complete with drive electronics, character decoding and software driver PROMs, power supply and attractive hardware and plastic cabinet interfaces directly with the 6800 and 8080 microprocessors. The printer is capable of printing a surprising 80 characters per second *bi-directionally*. Single quantity pricing is \$450, delivered from stock.

The model 40C utilizes a serially-driven printing element consisting of 7 print solenoids and print wires. The print wires are arranged vertically; the printing element is driven from either direction at constant speed. A synchronous motor driving a spirally grooved drum accomplishes this motion.

Ribbon feed is accomplished as a simple by-product of printing element motion. Ribbons are inexpensive and easily replaced.

All electronics for driving, decoding and program storage are powered by the self-contained D.C. power supply.



Directions To Homebrew Computer Club Meetingplace (S.L.A.C.)

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VT-4000 VIDEO TERMINAL
Product Announcement

New, from **Video Terminal Technology**, a video computer terminal with all the features of a professional terminal at hobbyist price. The **VT-4000** vider terminal displays 48 lines of 64 characters in a 5 by matrix. This provides the capability of displaying 3076 (3K) characters simultaneously—8 times the standard TV Typewriter's 16 lines of 32 characters.

The standard features of the **VT-4000** include: its own 4K of RAM, direct cursor addressing, scrolling up or down, five clearing controls, character enhance, all 32 control functions decoded, standard RS-232 or TTL serial I/O and selectable Baud rates (110, 300, 600, 1200, 2400, 4800 and 9600).

The **VT-4000** is available primarily in kit form in any configuration from single boards to 100% complete kits. Assembled and tested models can be purchased for a standard assembly fee. Please consult the current price list for detailed description of options available. For more information, contact **VTT**, 6108 Elmbridge Dr., San Jose, Ca. 95129.

**HOME BREW COMPUTER CLUB
NEWSLETTER**
P.O. Box 626
Mountain View, Ca. 94042

FIRST CLASS MAIL